

Psychophysiological Assessment of Posttraumatic Stress Disorder Imagery in World War II and Korean Combat Veterans

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We assessed the heart rate, skin conductance, and left lateral frontalis electromyographic responses of World War II (WWII) and Korean War male veterans to recollection of their combat experiences by using a script-driven imagery technique previously validated in Vietnam veterans (Pitman et al., 1990; Pitman, Orr, Forgue, de Jong, & Claiborn, 1987). Medication-free subjects were classified on the basis of criteria from the revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders* into posttraumatic stress disorder (PTSD; $n = 8$) and non-PTSD ($n = 12$) groups, which did not differ in overall combat exposure or severity of personal combat events. PTSD subjects' physiological responses during personal combat imagery were markedly larger than those of non-PTSD subjects, even though the self-reported emotional responses of the two groups were comparable. A physiological discriminant function derived from Vietnam veterans (Orr et al., 1990) correctly classified 7 of the 8 PTSD subjects (sensitivity was 88%) and 12 of the 12 non-PTSD subjects (specificity was 100%; $p < .001$).

Much of the impetus behind the inclusion of posttraumatic stress disorder (PTSD) in the modern psychiatric nomenclature (American Psychiatric Association, 1980) came from the recognition of the readjustment problems of Vietnam veterans during the decade following that conflict. Indeed, PTSD is sometimes misunderstood to be synonymous with the psychiatric problems of Vietnam veterans. Actually, PTSD can result from any combat or noncombat event that is "outside the range of usual human experience and that would be markedly distressing to almost anyone" (American Psychiatric Association, 1987, p. 250). The Vietnam War had no monopoly on such events. The psychiatric response to the stress of warfare has been recognized for centuries and has been variously described as irritable heart syndrome, shell shock, traumatic war neurosis, operational fatigue, and combat exhaustion (Schnurr, 1991; Trimble, 1984). Clinical evidence confirms the occurrence of *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed.; *DSM-III*; American Psychiatric Association, 1980) or revised *DSM-III* (*DSM-III-R*; American Psychiatric Association,

1987) PTSD in World War II (WWII; Fairbank, Hansen, & Fitterling, 1991; Hamilton & Canteen, 1987) and Korean War (Sutker, Winstead, Galina, & Allain, 1991) veterans. However, relatively little information regarding PTSD is available on veterans of these earlier wars (Dobbs & Wilson, 1960; van Kammen, Christiansen, van Kammen, & Reynolds, 1990; Wenger, 1948). It has been suggested that PTSD in WWII veterans may differ from PTSD in Vietnam veterans with regard to both the nature of the stressors and the subsequent symptomatic profile (Silver & Kelly, 1985). Moreover, in light of the differences in time passed since the occurrence of their traumatic combat events, comparing veterans of different eras may provide insight into the long-term course of PTSD.

Pitman (1988) and Pitman and Orr (1989) have used Lang's (1985) bioinformational theory of emotion as a framework for psychophysiological investigations of PTSD. Within Lang's theory, we have conceptualized PTSD as consisting of one or more emotion networks that, when activated, produce reexperiencing symptomatology, accompanied by measurable physiological arousal. An experimental technique devised by Lang and colleagues (Lang, Levin, Miller, & Kozak, 1983; Levin, Cook, & Lang, 1982) uses script-driven mental imagery as a means of accessing these networks. Our studies with this technique have shown that Vietnam veterans with PTSD show significantly larger physiological responses during personal combat imagery compared with mentally healthy Vietnam veterans (Pitman, Orr, Forgue, de Jong, & Claiborn, 1987) and Vietnam veterans with non-PTSD anxiety disorders (Pitman et al., 1990). Pitman (1988) has hypothesized that a feature of PTSD emotion networks is a tendency to maintain their structural integrity with the passage of time. This leads to the prediction that for cases of longer duration (e.g., post-Korean and post-WWII), physiological responses during traumatic imagery will serve as equally valid markers of PTSD. Evidence that the imagery of combat events is readily accessible in veterans of earlier wars has been provided by Rosen, Fields, Hand, Falsetti, and

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van Kammen (1989), who asked 26 WWII combat veteran psychiatric inpatients to picture in their minds the most stressful times of their lives. Fourteen (54%) selected military combat for this imagery.

An obstacle to the psychophysiological study of PTSD imagery in older veterans is recruiting subjects free of the medications that potentially confound physiological, especially autonomic, responses. Nevertheless, over a few years we were able to recruit a number of such subjects for the psychophysiological experiment reported here. In addition to psychophysiological assessment, we administered a battery of psychological tests and questionnaires previously used in the investigation of correlations between physiological responsivity and psychometric measures of PTSD in Vietnam combat veterans (Orr et al., 1990).

Method

Because the methodologies overlapped, portions of this section have appeared in Pitman et al. (1987) and Pitman et al. (1990).

Subjects

Subjects consisted of a convenience sample of American veterans of military combat in WWII (1941–1945) and the Korean War (1950–1953). All were White men, which reflected the local veteran demography. Subjects were recruited from populations of active and former Department of Veterans Affairs (VA) patients, former prisoners of war (POWs), responders to advertisements in the media, and by word of mouth. No subjects were inpatients at the time of the study. One of the investigators performed an initial screening interview, described the study, and obtained informed consent. Subjects were asked to abstain for 2 weeks prior to the laboratory session from any psychotropic medication or medication with potentially confounding autonomic effects (e.g., alpha- or beta-adrenergic blockers, anticholinergics, digitalis, or quinidine). Subjects unable or unwilling to comply with this restriction were excluded, as were subjects with potentially interfering medical conditions.

Following screening, each subject candidate was scheduled for a diagnostic interview by a psychiatrist or clinical psychologist using the Structured Clinical Interview for *DSM-III-R* (SCID; Spitzer & Williams, 1985). Interviewers were trained by the SCID's authors in its use prior to the study. The interviewer noted which if any elements of the diagnostic criteria for PTSD were satisfied and whether the subject met criteria for any other Axis I mental disorder. Subjects with a diagnosis of an organic mental, melancholic, bipolar manic, schizophrenic, paranoid, delusional, or other psychotic disorder, or with active substance dependence, were excluded. Subjects who had never met the criteria for PTSD were placed in the non-PTSD group ($n = 12$). Subjects who currently met the criteria for PTSD were placed in the PTSD group. Two subjects met the full criteria for past PTSD but missed the criteria for current PTSD by only one avoidance symptom; their psychometric profiles and clinical presentations were consistent with active PTSD. Because of the difficulty of finding PTSD subjects who satisfied the inclusion criteria, these 2 subjects were included in the PTSD group ($n = 8$). A remaining 6 subject candidates with past but not current PTSD were not included in either group.

The mean ages, education levels (highest grade completed), and level of combat exposure according to the scale of Keane et al. (1989) of the PTSD and non-PTSD subjects appear in Table 1, along with *t*-test results. There were no significant differences. Of the 8 PTSD subjects, 4 were WWII and 4 were Korean War veterans; of the 12 non-PTSD subjects, 10 were WWII and 2 were Korean War veterans ($p = .14$,

Fisher's exact test). One of the 8 PTSD subjects and 6 of the 12 non-PTSD subjects were former POWs ($p = .11$). Among the 8 PTSD subjects, comorbid Axis I disorders were limited to 1 subject with a current social phobia and current simple phobia and 1 subject with a current simple phobia. Among the 12 non-PTSD subjects, comorbid current Axis I disorders were limited to 1 subject with a panic disorder, social phobia, and simple phobia and 1 subject with dysthymia and obsessive-compulsive disorder.

Psychometrics

Each subject completed the following psychological tests and questionnaires: (a) Questionnaire Upon Mental Imagery (Sheehan, 1967), which provides an estimate of a subject's imagery ability (a lower score indicates better imagery ability); (b) Mississippi Scale for Combat-Related PTSD (Keane, Caddell, & Taylor, 1988); (c) Minnesota Multiphasic Personality Inventory (MMPI), including its Ptsd scale (Keane, Malloy, & Fairbank, 1984); (d) State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970); (e) Beck Depression Inventory (Beck, Rush, Shaw, & Emery, 1979); (f) Dissociation Experiences Scale (Bernstein & Putnam, 1986); (g) Internal-External (I-E) Locus of Control Scale (Rotter, 1966); and (h) Sensation-Seeking Scale, Form IV (Zuckerman, 1979).

Scripts

Following the diagnostic interview and psychometric tests, the subject was scheduled for an appointment with one of the present authors, a psychiatrist experienced in working with Vietnam veterans; he was unaware of group membership. The psychiatrist composed five individualized scripts portraying actual experiences from the subject's past after the method of Lang's group (Lang et al., 1983; Levin et al., 1982), including the two most stressful combat¹ experiences that the subject could recall, the most stressful experience that the subject could recall over his lifetime before military service (precombat traumatic experience), a positive experience, and a neutral experience. The subject was first asked to describe each experience in writing on a script preparation form (available on request) and then to select from a "menu" of subjective visceral and muscular reactions appearing at the bottom of the form those that he remembered accompanied the experience. The psychiatrist reviewed the subject's written responses and asked him to clarify or expand on the details when necessary. The psychiatrist then composed a 30-s script that portrayed each experience in the second person, present tense, incorporating five different visceral and muscular reactions, or as many as the subject selected, whichever was less. An example of a previous subject's individualized combat script has been presented elsewhere (Pitman et al., 1987).

After the subject finished an individual script-preparation form, he was asked to complete the Impact of Event Scale (IOES; Horowitz, Wilner, & Alvarez, 1979; Zilberg, Weiss, & Horowitz, 1982) as it pertained to the experience that he had just described. The IOES measures on 0–3 Likert-type scales the frequency during the past week of various PTSD-related symptoms connected with the experience. Two scores were calculated from this instrument for each individualized script: an Intrusion scale score and an Avoidance scale score. The use of the IOES in this study differed from the use of the Mississippi and MMPI PTSD scales, in that the latter two scales provided an estimate of the overall severity of combat-related PTSD symptomatology and

¹ Included under personal "combat" events were events that occurred to prisoner-of-war subjects during their captivity, if they considered those events to be their most traumatic.

Table 1
Demographic and Psychometric Data

Variable	PTSD (<i>n</i> = 8)		Non-PTSD (<i>n</i> = 12)		<i>t</i> (18)	<i>p</i>	Phys. <i>r</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Demographics							
Age	65.3	5.5	68.6	5.1	1.4	.19	-.34
Education	14.4	2.6	13.8	2.0	0.6	<i>ns</i>	.09
Combat exposure	27.5	10.1	24.5	6.8	0.8	<i>ns</i>	.02
Event ratings							
Individual precombat traumatic severity rating	9.3	1.4	7.7	1.7	2.2	.04	.34
Symptomatic impact (IOES)							
Intrusion	3.6	5.8	2.3	4.0	0.6	<i>ns</i>	-.09
Avoidance	5.3	7.0	2.3	3.9	1.2	.23	.09
Individual combat (averaged) severity rating	10.7	0.8	10.8	0.6	0.2	<i>ns</i>	-.08
Symptomatic impact (IOES)							
Intrusion	9.6	7.1	2.5	4.2	2.8	.01	.72***
Avoidance	12.0	5.4	3.3	3.4	4.5	< .001	.72***
MMPI validity scales							
<i>L</i>	52.6	5.7	48.2	7.7	1.4	.18	.07
<i>F</i>	72.6	17.9	59.9	12.6	1.8	.09	.28
<i>K</i>	50.0	8.1	50.5	8.6	0.1	<i>ns</i>	.01
<i>F</i> minus <i>K</i> (raw scores)	2.4	4.0	4.5	8.2	0.7	<i>ns</i>	-.17
Dissimulation-Revised (<i>DS-R</i>)	66.5	14.3	55.0	11.1	2.0	.06	.34
MMPI clinical scales							
Hypochondriasis (1)	79.3	17.6	66.3	16.2	1.7	.11	.32
Depression (2)	84.3	24.6	66.8	18.4	1.8	.09	.38
Hysteria (3)	75.0	10.3	63.1	12.4	2.2	.04	.49*
Psychopathic Deviate (4)	70.1	5.1	60.9	16.1	1.6	.13	.33
Masculinity-Femininity (5)	61.8	5.8	59.1	11.2	0.6	<i>ns</i>	.13
Paranoia (6)	66.5	11.6	54.6	8.4	2.6	.02	.28
Psychasthenia (7)	77.8	17.5	58.5	12.4	2.8	.01	.45
Schizophrenia (8)	82.3	18.5	61.2	15.9	2.7	.02	.40
Hypomania (9)	61.9	10.1	57.8	11.2	0.8	<i>ns</i>	.13
Social Introversion (0)	62.1	19.4	54.5	12.1	1.1	.30	.18
Anxiety (A)	60.1	12.9	50.5	11.9	1.8	.09	.29
Alcoholism (MacAndrew)	58.8	18.7	54.8	7.5	0.6	<i>ns</i>	-.13
Overcontrolled Hostility (OH)	55.4	7.1	49.2	10.0	1.5	.15	.13
Ptds	25.3	10.9	11.4	10.2	2.8	.01	.49*
Subtle (sum of five subscales)	263.8	34.9	273.5	31.5	0.6	<i>ns</i>	-.06
Obvious (sum of five subscales)	351.9	68.2	279.6	59.3	2.5	.02	.41
Other psychometrics							
Mississippi Scale for Combat-Related PTSD	110.5	17.9	75.5	17.5	4.4	< .001	.64**
Anxiety Inventory							
State	48.3	12.1	34.0	13.4	2.3	.04	.54*
Trait	48.4	12.6	33.8	1.3	2.4	.03	.38
Beck Depression Inventory	19.4	11.2	8.5	5.5	2.8	.01	.47*
Locus of Control Scale	10.3	6.2	6.2	3.6	1.7	.10	.50*
Dissociative experiences	59.8	18.6	55.1	14.0	0.6	<i>ns</i>	.01
Questionnaire Upon Mental Imagery	74.9	25.2	74.3	25.2	0.1	<i>ns</i>	-.10
Sensation Seeking-General	6.0	4.2	8.2	4.9	1.0	.33	-.23

Note. PTSD = posttraumatic stress disorder; IOES = Impact of Event Scale; and MMPI = Minnesota Multiphasic Personality Inventory. Phys. *r* refers to the correlation between the item in the table and physiological responsivity to individualized combat imagery (see the text for explanation).

* $p < .05$. ** $p < .01$. *** $p < .0013$. (The .0013 significance level represents a .05 significance level with a Bonferroni correction for 38 correlations.)

the IOES provided an estimate of the PTSD symptomatic impact of a discrete combat event.

In addition to the individualized scripts, we used six standard scripts portraying various hypothetical experiences, which were the same for all subjects. The standard scripts (available on request) included two neutral experiences (sitting in a lawn chair and looking out of a living room window), a combat experience (experiencing an incoming mortar and rocket attack), a positive experience (being at the beach), an action experience (riding a bicycle), and a fear experience (speaking in public). The standard scripts also incorporated visceral and muscular responses that might be expected in the respective situations. The standard scripts, with the exception of the combat script, were the same as those previously used by Lang et al. (1983). Each script was recorded in a neutral voice by one of the present authors for playback in the laboratory.

Three experts blind to diagnosis rated a typed copy of each script on a 0–12 Likert-type scale for the amount of trauma that experience would have produced for the typical combat veteran. The interrater reliability (intraclass correlation coefficient) for these ratings was .63. The three ratings were averaged for each script, providing a measure of the apparent severity of the specific experience.

Apparatus

The laboratory session took place in a 3.35 m × 2.74 m (11 ft × 9 ft) humidity- and temperature-controlled, sound-attenuated subject room, connected via wires to an adjoining portion of the laboratory in which the experimental apparatus was located. The subject was seated in a comfortable armchair. A monitor in the subject room was used to display the emotion self-report scales, and subjects' self-reports were entered into the computer via a joystick. A Coulbourn Modular Instrument System was used in the recording of physiological analog signals, which were monitored by Hitachi V-212 oscilloscopes. Dependent physiological measures included heart rate (HR), skin conductance (SC), and electromyogram (EMG) of the left lateral frontalis facial muscle. EMG was obtained through Beckman-type 4-mm diameter silver/silver chloride surface electrodes filled with electrolyte paste, placed according to published specifications (Fridlund & Cacioppo, 1986), connected to a Coulbourn Hi-Gain Bioamplifier (Model Number S75-01) and integrated using a 0.5-s time constant through a Coulbourn Contour-Following Integrator (Model Number S76-01). SC level was obtained through Beckman-type 9-mm diameter silver/silver chloride surface electrodes filled with isotonic paste (Fowles et al., 1981), placed on the subject's left palm connected to a Coulbourn Skin Conductance Module (Model Number S71-11), which used a constant voltage (0.5 V) and was used in the direct-coupled mode (Fowles et al., 1981). HR was obtained via Beckman-type 9-mm surface electrodes filled with electrolyte paste placed on each arm just above the interior wrist and connected to a Coulbourn Hi-Gain Bioamplifier (Model Number S75-01) inputting to a Coulbourn Tachometer (Model Number S77-26). Analog outputs of the physiological modules were digitized by a Coulbourn Analog-to-Digital Converter (Model Number S25-12) prior to sampling. An IBM-compatible computer was used for controlling the tape recorder and the self-report graphics monitor and for sampling and storing the digitized physiological signals. The computer was interfaced with the instrument system through a Coulbourn LabLinc Computer Interface.

Procedure

After orientation to the subject room, electrodes were attached and subjects listened to a 3-min relaxation instruction tape. The subject was informed that a series of scripts would be presented after this tape. Each script presentation consisted of four sequential 30-s periods: base-

line, read, imagery, and recovery. The subject was instructed to listen carefully during the playing of the scripts and to attempt to imagine as vividly as possible each experience as it was presented (read period) and on script termination to continue to imagine the experience from beginning to end (imagery period) until he heard a tone. He was further instructed to stop imagining the script at the tone and to relax (recovery period) until a second tone was heard. At this time, he made his self-reports on 12-point Likert-type scales. The computer was programmed to start the baseline period for the next script after a 1-min rest period or after the subject's HR had returned to within 5% of its value during the previous baseline period, whichever was longer. For all scripts, all subjects' HRs returned to this criterion within 3 min; usually, HR returned to criterion within 1 min.

There were 11 script presentations. Following the first (standard neutral) script, there were two blocks of 5 scripts each. Each block contained one of the individualized combat scripts, one of the remaining neutral scripts, one of the positive scripts, either the individualized precombat traumatic script or the standard fear script, and either the action or the standard combat script. No two of the combat, precombat traumatic, or fear scripts were presented sequentially. Within these constraints, the order of script presentation was randomized. For each script, the physiological variables were sampled at the rate of 2 Hz. At the conclusion of the experiment, each subject was debriefed and treatment options were discussed with him if he wished.

Data Reduction

For each script, a change score, or response, was calculated for each physiological dependent variable by subtracting the preceding baseline period mean from the imagery period mean. The physiological responses to the two personal combat scripts were analyzed individually and after averaging. Pooling data from previous studies (Orr et al., 1990; Pitman et al., 1990; Pitman et al., 1987), we used the Statistical Analysis System's DISCRIM procedure (SAS Institute, 1982, p. 381) to derive a discriminant function from the HR, SC, and EMG responses during imagery of the two personal combat experiences (averaged) of 25 PTSD and 16 mentally healthy Vietnam combat veteran subjects, who had been studied according to the same methodology as used here. The derived Vietnam veteran function was used to generate a posterior probability of each Korean or WWII subject's belonging to the physiological PTSD category. This probability served as a measure of a subject's "physiological responsivity" to his personal combat imagery.

Results

Psychometrics

The psychometric profiles of the PTSD and non-PTSD groups, with results of *t* tests, are presented in Table 1. Table 1 also shows the Pearson product-moment correlations of each psychometric variable with physiological responsivity. The criterion for statistical significance was adjusted by means of a Bonferroni correction to .0013 because of 38 correlations. It can be seen that only the IOES Intrusion and Avoidance scales completed for the combat events significantly correlated with physiological responsivity, although the correlation with the Mississippi Scale for Combat-Related PTSD came close ($p = .003$).

The blind severity ratings of subjects' personal combat events were essentially the same in the two groups (see Table 1). However, these combat experiences produced much greater symptomatology in the PTSD than in the non-PTSD subjects, as revealed by the differences in IOES scores.

Psychophysiology

Baseline physiological levels. The physiological levels during the baseline period preceding the first script were as follows: for HR, PTSD, $M = 71.6$ beats per min, $SD = 12.2$, and non-PTSD, $M = 71.8$ beats per min, $SD = 11.7$, $t(18) = 0.0$, ns ; for SC, PTSD, $M = 2.6 \mu S$, $SD = 1.9$, and non-PTSD, $M = 3.5 \mu S$, $SD = 2.7$, $t(18) = 0.9$, ns ; and for EMG, PTSD, $M = 5.3 \mu V$, $SD = 5.9$, and non-PTSD, $M = 4.3 \mu V$, $SD = 2.9$, $t(18) = 0.5$, ns .

Responses during imagery. Analyses of variance (ANOVAs) for repeated measures with Geisser-Greenhouse (Geisser & Greenhouse, 1958) corrections were performed separately for the HR, SC, and EMG response scores during imagery, with scripts as the repeated measure. An ANOVA for HR responses revealed a group main effect, $F(1, 17) = 10.3$, $p = .005$; script main effect, $F(10, 170) = 5.9$, $p < .001$; and a Group $\times$ Script interaction, $F(10, 170) = 4.5$, $p = .002$. An ANOVA for SC responses revealed a group main effect, $F(1, 17) = 12.1$, $p = .003$; script main effect, $F(10, 170) = 8.3$, $p < .001$; and a Group $\times$ Script interaction, $F(10, 170) = 5.1$, $p = .005$. An ANOVA for EMG responses revealed a group main effect, $F(1, 17) = 1.2$, $p = .28$; script main effect, $F(10, 170) = 4.7$, $p = .02$; and a Group $\times$ Script interaction, $F(10, 170) = 3.0$, $p = .07$.

Table 2 shows group mean physiological responses during imagery of each script, along with results of multivariate ANOVAs (MANOVAs) with HR, SC, and EMG responses as simultaneous dependent variables, and univariate t tests. The MANOVAs revealed that the physiological response scores of the PTSD and non-PTSD groups differed significantly only during imagery of the personal combat scripts.

Figure 1 shows the group mean physiological responses aver-

aged for the two personal combat scripts. As shown, t tests revealed significantly greater HR and SC responses during personal combat imagery in the PTSD subjects, even though the mean HR responses of the non-PTSD subjects were significantly greater than zero.

In order to examine the emotional responsivity associated with combat versus noncombat traumatic events, we averaged PTSD subjects' responses during personal combat imagery (see Figure 1) and compared them with their responses during personal precombat traumatic imagery (see Table 2). The results of paired t -test comparisons were as follows: for HR responses, $t(6) = 2.2$, $p = .07$; for SC responses, $t(6) = 2.0$, $p = .09$; and for EMG responses, $t(6) = 1.4$, $p = .20$. In order to examine the effect of personalizing the combat script, we compared PTSD subjects' responses to their personal combat scripts (see Figure 1) with their responses to the standard combat script (see Table 2). The results of paired t -test comparisons were as follows: for HR responses, $t(7) = 1.8$, $p = .11$; for SC responses, $t(7) = 2.4$, $p = .04$; and for EMG responses, $t(7) = 1.5$, $p = .19$.²

Discriminant analysis. Application of the Vietnam veteran discriminant function described earlier to the present WWII and Korean veterans' physiological responses resulted in the correct identification of 7 of the 8 PTSD subjects (sensitivity was 88%) and 12 of the 12 non-PTSD subjects (specificity was 100%; Fisher's exact test, $p < .001$).

² Analyses for the 6 subjects with posttraumatic stress disorder who had been ground combatants revealed the following: for heart rate responses, $t(5) = 1.3$, $p = .25$; for skin conductance responses, $t(5) = 2.4$, $p = .06$; and for electromyographic responses, $t(7) = 1.7$, $p = .15$.

Table 2
Physiological Responses During Script-Driven Imagery

Script	HR				SC				EMG				<i>F</i> (3, 16)	<i>p</i>
	PTSD		Non-PTSD		PTSD		Non-PTSD		PTSD		Non-PTSD			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Personal														
First combat	12.8	11.8	2.7	2.6**	1.4	1.6	0.2	0.3*	6.3	11.5	0.8	1.0	4.7	.01
Second combat	6.9	4.8	0.3	1.5**	0.8	1.1	-0.1	0.2**	0.0	2.5	-0.2	2.2	8.9	.001
Precombat traumatic	6.4	7.9	1.0	3.1*	0.2	0.4	0.1	0.4	0.1	1.3	0.3	1.4	2.3	.12
Positive	1.0	3.8	1.5	4.3	0.1	0.4	0.0	0.3	0.7	1.9	-0.3	1.1	< 1	<i>ns</i>
Neutral	3.2	6.4	-0.8	3.8	0.0	0.3	0.0	0.2	-0.5	0.5	-0.1	1.1	1.9	.17
Standard														
Lawn chair	0.0	2.6	1.7	2.0	0.0	0.4	0.0	0.3	-0.2	0.6	0.5	1.0	2.3	.12
Living room	3.8	9.6	-0.6	2.2	0.0	0.3	-0.2	0.2	-0.5	1.0	-0.7	1.8	< 1	<i>ns</i>
Combat ^a	5.5	5.9	1.4	2.7*	0.4	0.6	0.0	0.3	0.2	0.6	-0.4	1.2	1.9	.18
Beach	0.5	4.2	0.6	1.5	-0.2	0.2	-0.2	0.3	-0.1	0.5	-0.2	1.5	< 1	<i>ns</i>
Bicycle	0.4	3.3	0.7	1.6	-0.1	0.2	-0.1	0.3	-0.5	1.0	0.0	1.1	< 1	<i>ns</i>
Public speaking	2.7	4.9	2.0	3.1	-0.1	0.3	0.0	0.2	-0.1	0.4	0.2	1.1	< 1	<i>ns</i>

Note. PTSD = posttraumatic stress disorder; MANOVA = multivariate analysis of variance; HR = heart rate response, measured in beats per minute; SC = skin conductance response, measured in microsiemens; and EMG = left lateral frontalis electromyographic response, measured in microvolts. There were 8 subjects in the PTSD group and 12 subjects in the non-PTSD group.

^a Because not all subjects had experienced the kind of ground combat portrayed in the standard combat script, these analyses were repeated for the 6 PTSD and 8 control subjects who had been ground combatants. The subgroup univariate results were as follows: for HR, PTSD, $M = 5.2$ and $SD = 4.5$; control, $M = 2.5$ and $SD = 2.6$, $t(12) = 1.5$, $p = .17$. For SC, PTSD, $M = 0.38$ and $SD = 0.60$; control, $M = .01$ and $SD = 0.42$, $t(12) = 1.3$, $p = .21$. For EMG, PTSD, $M = 0.2$ and $SD = 0.6$; control, $M = -0.5$ and $SD = 1.2$, $t(12) = 1.3$, $p = .23$. These subgroup means were comparable to the means of the full groups, but the HR difference was no longer statistically significant.

* $p < .05$ and ** $p < .01$ on t tests ($df = 18$).

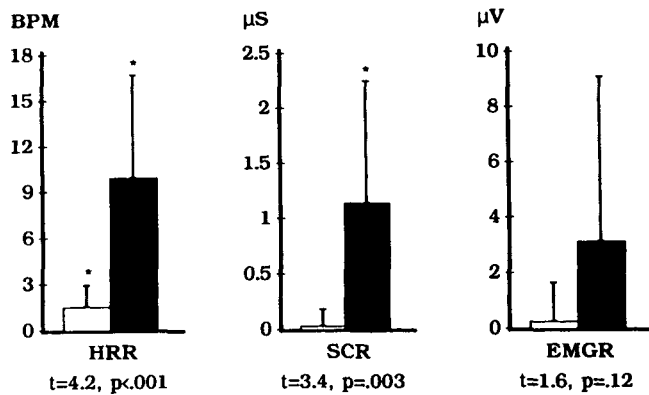


Figure 1. Physiological responses during script-driven imagery of personal combat experiences (averaged). (Open bars indicate subjects without posttraumatic stress disorder [PTSD; $n = 12$]. Closed bars indicate PTSD subjects [$n = 8$]. Lines above bars indicate standard deviations. Asterisks designate mean physiological responses that were significantly different from zero. BPM = beats per minute; HRR = heart rate response; SCR = skin conductance response; and EMGR = left lateral frontalis electromyographic response. For all t tests, $df = 18$; p values were two-tailed.)

Emotion Self-Reports

Table 3 shows the PTSD and non-PTSD groups' mean self-reported ratings of emotional responses during imagery of the personal combat scripts. It can be seen that the groups were comparable on nearly all emotion self-reports.

Discussion

The results of this psychophysiological investigation of WWII and Korean War combat veterans are noteworthy for their replication of results previously reported in Vietnam combat veterans using the same methodology (Orr et al., 1990; Pitman et al., 1990; Pitman et al., 1987). Compared with the previ-

ously obtained data in Vietnam veterans, HR responses yielded a relatively better, and EMG responses a relatively poorer, discrimination of PTSD from non-PTSD subjects. SC responses appeared to provide the most reliable physiological measure for discriminating the emotional responses of PTSD from non-PTSD subjects. In the present study, as well as in earlier work, the magnitudes of SC responses during imagery of the combat-related experiences were much larger in the PTSD compared with the non-PTSD group. There were no significant group differences in SC responses to the non-combat-related imagery. Overall, the physiological responses to the personal combat scripts of the PTSD and non-PTSD veterans of earlier wars are remarkable for their close correspondence in pattern and magnitude to those of PTSD and non-PTSD Vietnam veterans. This supports a pathophysiological commonality among combat-related stress disorders of different eras.

The magnitudes of the HR and SC responses in the PTSD subjects studied here were highly similar to the responses of simple phobic subjects studied by Cook, Melamed, Cuthbert, McNeil, and Lang (1988) during imagery of their phobic objects or situations. On the basis of their increased physiological responsiveness to personal traumatic imagery, PTSD subjects appear to be most similar to the simple phobics and least similar to the agoraphobics studied by Cook et al. This points to high coherence and cue specificity for the emotion networks involved in PTSD, as in simple phobia. However, PTSD differs from simple phobia in that its symptomatology extends beyond cue-related arousal to include generalized sympathetic hyperarousal (reviewed in Pitman, 1993) and increased unconditioned responding (Shalev, Orr, Peri, Schreiber, & Pitman, 1992).

Comparing PTSD subjects' responses between scripts revealed two additional trends, neither of which was unexpected. First, the PTSD subjects appeared to be more responsive during imagery of their personal combat, as opposed to their personal precombat traumatic experiences. This difference was significant for HR and SC responses on one- but not two-tailed t tests, supporting the finding of Rosen et al. (1989) that mili-

Table 3
Self-Reported Emotional Responses to the Individualized Combat Scripts (Averaged)

Variable	PTSD		Non-PTSD		$t(18)$	p
	M	SD	M	SD		
Vividness	10.6	2.2	10.6	2.0	0.0	<i>ns</i>
Emotion dimensions						
Arousal	10.6	1.6	10.3	2.1	0.4	<i>ns</i>
Valence (pleasantness)	0.4	0.4	0.6	1.0	0.6	<i>ns</i>
Dominance (control)	4.4	2.7	3.9	2.8	0.4	<i>ns</i>
Discrete emotions						
Happiness	1.7	2.7	0.1	0.4	2.0	.06
Sadness	7.4	3.7	9.4	3.6	1.2	.26
Fear	9.3	2.3	9.3	3.3	0.0	<i>ns</i>
Surprise	9.1	3.1	8.4	3.5	0.4	<i>ns</i>
Anger	9.3	2.8	9.4	3.0	0.1	<i>ns</i>
Disgust	6.9	4.3	8.3	3.6	0.8	<i>ns</i>
Guilt	5.0	3.7	3.6	3.0	0.8	<i>ns</i>

Note. PTSD = posttraumatic stress disorder. There were 8 subjects in the PTSD group and 12 subjects in the non-PTSD group.

tary combat was the most traumatic experience in those subjects' life histories. Second, there was a trend for PTSD subjects to be more responsive during personal, as opposed to standard, combat imagery. This supports the assumption that personalizing scripts to subjects' actual past experiences increases cue specificity and results in better access to the PTSD emotion network.

Of special interest in this study was the finding that the self-reported emotional responses of the non-PTSD subjects to imagery of their combat events were as high as those of the PTSD subjects. However, the non-PTSD subjects' subjective reactions were accompanied by little physiological arousal. Dissociation between self-reported and physiological responses is a common observation in the investigation of emotion (e.g., Lang, 1985; Mewborn & Rogers, 1979). Lang noted that correlations between self-reported fear and psychophysiological arousal seldom accounted for more than 10% of the variance. Considering this dissociation, the results obtained here suggest that physiological reactivity on exposure to events that resemble the traumatic event (*DSM-III-R* Criterion D.6) has more diagnostic value for PTSD than self-reported psychological distress (*DSM-III-R* Criterion B.4; American Psychiatric Association, 1987, p. 250).

The psychometric results obtained in the present study of WWII- and Korean-era veterans are similar to those reported by Orr et al. (1990) for Vietnam combat veterans, which also supports a psychopathological commonality among combat-related stress disorders of different eras. As in the earlier work, the scales that best differentiated the PTSD from non-PTSD subjects, and that produced the highest correlations with physiological responsivity to personal combat imagery, were those specifically designed to measure PTSD symptomatology (viz., the IOES and the Mississippi Scale for Combat-Related PTSD). The pattern of MMPI results obtained here in the largely non-POW, WWII and Korean War PTSD veteran subjects (i.e., elevations on Scales *F* 1, 2, 3, 7, and 8) was similar to that previously reported in WWII and Korean POW subjects (Goldstein, van Kammen, Shelly, Miller, & van Kammen, 1987; Klonoff, Clark, Horgan, Kramer, & McDougall, 1976; Sperr, Sperr, Craft, & Boudewyns, 1990; Sutker & Allain, 1991; Sutker et al., 1991).

The physiological responses associated with the recall of traumatic experiences that occurred more than half a lifetime earlier in the WWII and Korean PTSD veterans in this report dramatically demonstrate what has been called the "timelessness" of PTSD (Pitman, 1988). Still to be explicated are the pathophysiological processes that underlie the formation and perpetuation of such durable memory traces and conditioned emotional responses.

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Hill Appointed Editor of the *Journal of Counseling Psychology*, 1994-1999

The Publications and Communications Board of the American Psychological Association announces the appointment of Clara E. Hill, PhD, University of Maryland, as editor of the *Journal of Counseling Psychology* for a 6-year term beginning in 1994. As of January 1, 1993, manuscripts should be directed to

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Manuscript submission patterns for the *Journal of Counseling Psychology* make the precise date of completion of the 1993 volume uncertain. The current editor, Lenore W. Harmon, PhD, will receive and consider manuscripts until December 31, 1992. Should the 1993 volume be completed before that date, manuscripts will be redirected to Dr. Hill for consideration in the 1994 volume.